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COLLEGE STATION TEXAS 77843

College of Agriculture
College of Engineering
College of Geosciences
College of Science

QUARTERLY PROGRESS REPORT

April 13, 1977 - July 13, 1977

TITLE: Applied Regional Monitoring of the Vernal Advancement and Retrogradation (Green Wave Effect) of Natural Vegetation in the Great Plains Corridor

CONTRACT: NAS5-20796

PRINCIPAL INVESTIGATOR: J.W. Rouse, Jr.

PROJECT DESCRIPTION:

A twelve-month extension to the Landsat-2 Follow-On study was incorporated as Modification Number 9 of the original contract. The original Landsat-2 study evaluated the capability for regional vegetation condition monitoring through quantitative assessment of Landsat MSS data. The semi-arid to sub-humid rangelands of the Mixed Prairie region in the central United States served as the study area. The results of this aspect of the study are reported in RSC Final Report 3018-6 (January 1977). The modification of the Landsat-2 follow-on study extends the project to rangelands in west Texas. The study will monitor a variety of vegetation conditions to establish threshold values and limitations for using Landsat to measure herbaceous biomass under typical arid and semi-arid

range conditions. The influence of ground cover in sparsely vegetated regions and the changing herbaceous biomass will be quantitatively related to Landsat MSS data. Thresholds of brush canopy cover influencing spectral signatures will be determined in relation to open rangelands supporting similar herbaceous biomass. The overall objective of this follow-on study is to determine the effectiveness of Landsat data in measuring and monitoring the arid and semi-arid rangeland vegetation biomass and growth conditions which are of direct concern to rangeland managers in these regions.

SUMMARY:

During the first quarter of the project extension, sites were established and the first samples were taken. Two sampling trips were required to obtain one set of ground data and coincident cloud-free satellite data for all five test sites. Computer generated, geometrically rectified grey-maps were processed from existing CCT's for the five locations, and sites were delineated. Most of the ground truth data for the first sampling period have been keypunched, and some preliminary statistical analyses have been made. Aerial photography for brush density mapping was acquired in June in conjunction with another project. Orders for Landsat CCT's and imagery have been placed for the first Landsat coverage period in conjunction with the first sampling period.

ACTIVITIES AND ACCOMPLISHMENTS:

Project personnel met with representatives of the Soil Conservation Service (SCS) and the University of Texas Lands in late April and discussed project objectives and site requirements. With the cooperation and assistance of these representatives, five to eight sampling sites were established at the five west Texas test site locations through on-site inspections (Fig. 1). Aerial photography from a previous project facilitated preliminary sampling site determinations at three test site locations (Big Lake, Crane, and Andrews). SCS field personnel provided invaluable assistance in selecting sampling sites at the other two locations (Pyote and Hudspeth). All of the test sites selected are on management units administered by the University of Texas Lands, Surface Leasing Department. These management units are leased to private ranch operators for livestock grazing.

Prior to the first sampling trip, maps, equipment, and supplies were acquired, and sampling schemes were developed. The first sampling period was chosen to coincide with the May 18-22, 1977 Landsat-2 overpasses over the study areas (Fig. 2). During the eight day field trip (May 16-24), final site selections were made at all locations and field personnel were familiarized with the sampling sites at each of the test sites and trained in the sampling technique. Cloud coverage at the time of satellite

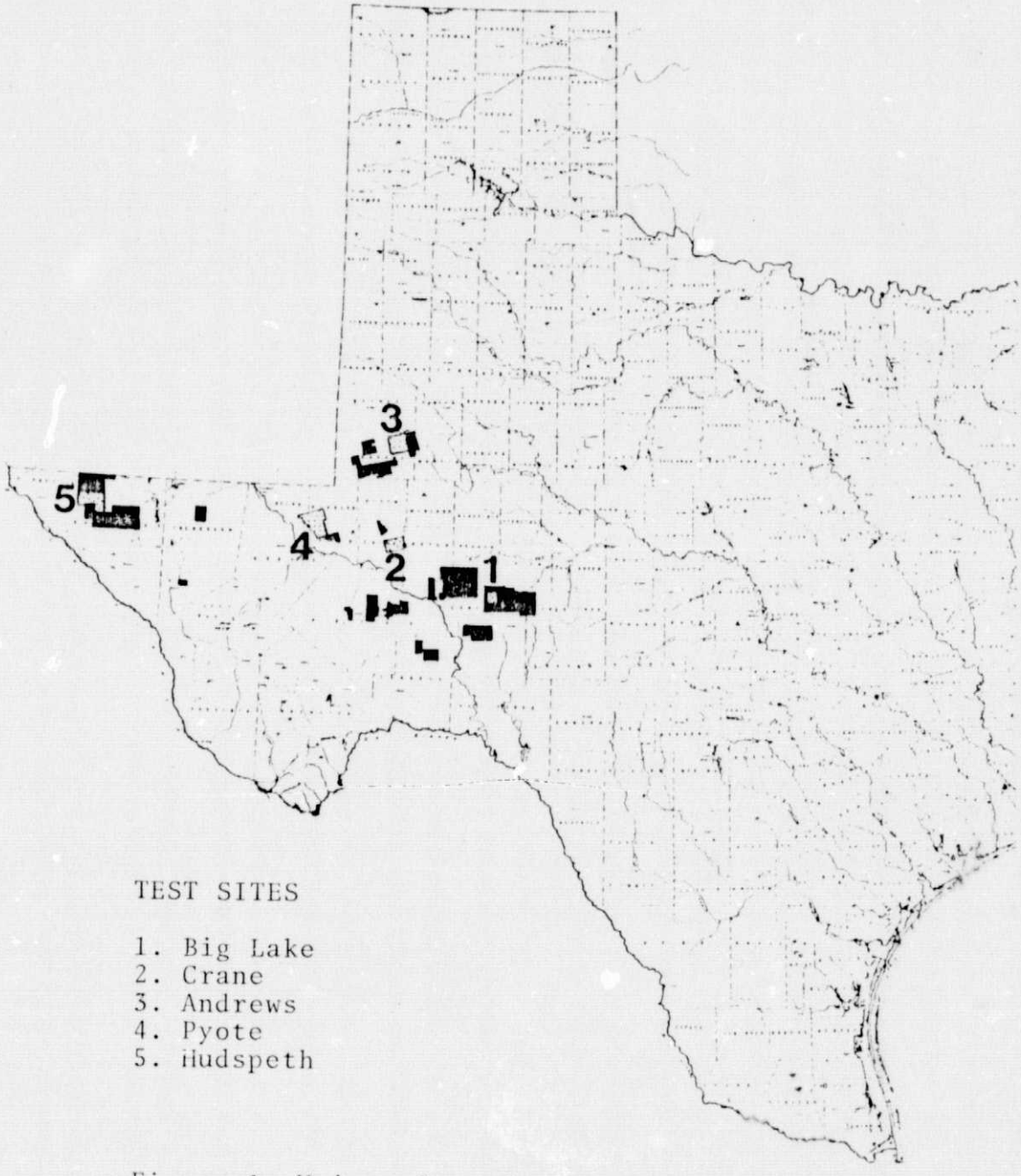
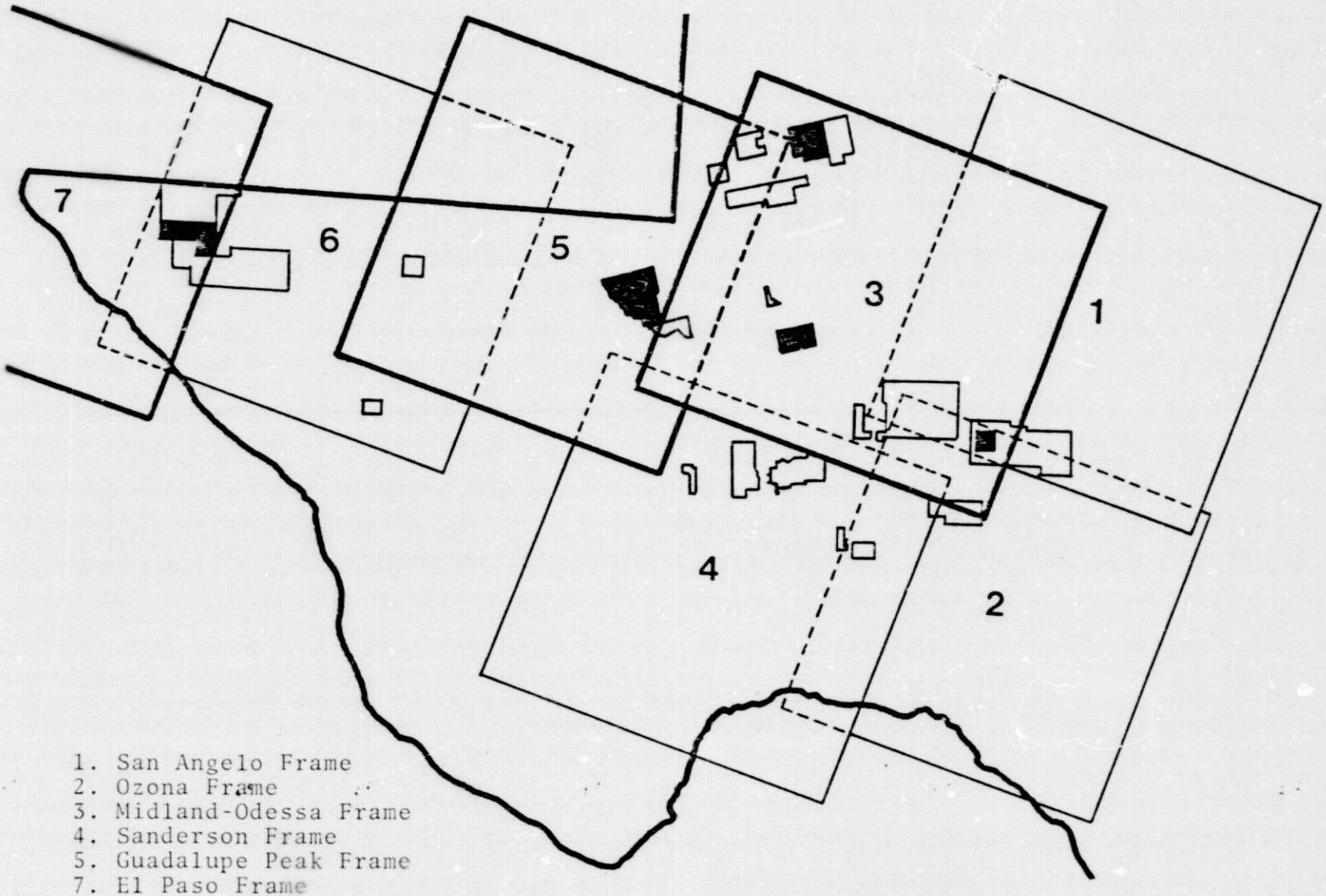


Figure 1. University of Texas Lands (solid) and locations of five project test sites (stippled) in West Texas.



1. San Angelo Frame
2. Ozona Frame
3. Midland-Odessa Frame
4. Sanderson Frame
5. Guadalupe Peak Frame
7. El Paso Frame

Figure 2. Nominal Landsat Coverage of University of Texas Lands. Frames 3, 5, and 7 were ordered (6-6-77, 2866-16213; 6-7-77, 2867-16271; 5-22-77, 2851-16395, respectively) to correspond with the spring sampling period.

overpass was determined by on-site inspection of sky conditions at the scheduled time for Landsat overpass. Sky conditions were evaluated by Remote Sensing Center field personnel at the Andrews and Hudspeth test sites and by Soil Conservation Service perscnnel for the Big Lake, Crane, and Pyote test sites.

Extensive cloud cover at mid-morning over Big Lake, Crane, Andrews, and Pyote locations (May 18-20 overpasses) prevented acquisition of good satellite data. Consequently, sampling at these sites was restricted to estimating and clipping a subset of "representative" plots for preliminary indications of this season's biomass. Field personnel were trained in the sampling techniques at these sites. At Crane and Andrews half of the sampling sites were sampled as scheduled. The Hudspeth test site location was clear at overpass, and a full complement of samples were taken at the five sample sites.

Upon returning to the Remote Sensing Center, plans were made for sampling to correspond with the first cloud-free coverage of the four remaining test sites. Cloud-free site conditions at the time of satellite overpass were recorded during June 5-7. Ground sampling was initiated on June 6 and was completed by June 13. Big Lake vegetation was relatively green but was under moisture stress and had matured during the hot, dry period immediately preceeding and during sampling. The Andrews, Pyote, Crane, and Hudspeth sites were very dry, and consequently supported very little green biomass.

All of the ground data except that dealing with biomass separations has been keypunched onto computer data cards. The ground data includes cover estimates, species composition, and fresh and oven-dry vegetation biomass and soil moisture. Most of the separation of vegetation samples into green and brown components has been completed. Statistical analyses of sample sizes needed with respect to variation of "within" site ground data have been generated for the May sampling period with Hudspeth, Crane, and Andrews ground data. Following complete analyses, field crews will be able to allocate sampling time more efficiently for future sampling.

Aerial photography (35 mm) was acquired as a joint effort with an existing project with different objectives on the University of Texas Lands. Flight lines were mapped for all locations, and photography was taken on May 21 at Big Lake, Crane, and Andrews, and on June 4 at the Pyote and Hudspeth sites. Color Ektachrome photos were of good quality, but the color IR film was improperly exposed. The color photos will aid the determination of actual brush densities on the sites selected for brush canopy influence on spectral signatures.

Site locations have been plotted on geometrically rectified computer grey-maps generated from existing Landsat CCT's. These maps will facilitate more efficient data extraction of 1977 Landsat data. Orders for Landsat CCT's for 1977 data have been placed with the EROS Data Center.

PROBLEM AREAS:

Weather predictions for cloud-free Landsat-2 overpass were projected as being favorable for the first field sampling period. However, extensive cloud cover was observed in the mornings at satellite overpass, which prevented satellite data acquisition for Big Lake, Crane, Andrews, and Pyote at this time. Thus, a full complement of ground samples was not taken on the trip for these sites, since there was no satellite data. Although the planned trip was shortened, travel time and man hours had to be expended with minimal data acquisition.

The lag-time in receiving Landsat CCT's from the EROS Data Center is of considerable concern. The EROS Data Center indicates that it takes three to five weeks following Landsat overpass before information is logged into their system and available for ordering. After an order is placed for data that has been logged in, it takes six to eight weeks before CCT's can be produced and shipped. This enormous time-lag is very undesirable. The greatest problem is anticipated near the end of the project. A late September sampling period will be required and satellite data for this time may not be received until late December, when project activities should be completed.

Aerial CIR photography (35 mm) that was acquired in the spring was incomplete and of generally poor quality. Consequently, additional photography will be required. It is anti-

cipated that large format (9") color IR photography will be taken in mid-September coincident with a scheduled ground sampling and Landsat overpass.

SCHEDULED ACTIVITIES:

Weather conditions will be monitored in west Texas to obtain a different set of growing and biomass conditions for the next sampling period. It is anticipated that these conditions will occur in late July or early August, and again in late September.

Large format (9") color infrared aerial photography is scheduled to be acquired for the five test sites in September. Using photo interpretation techniques, brush density will be assessed for the sample sites from these photographs.

Data processing will be continued and procedures reformulated for more efficient computer processing of new data. Linear regression will be used in a double sampling technique to determine green biomass from clip plot data when grass separations are completed. Landsat data processing will begin upon receipt of the first 1977 CCT data.